

Conveying emotions through physical objects

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1. Introduction

This thesis is conducted in collaboration with a Finnish biotech company Nightingale Health. The company is focused on solving global health issues, such as chronic diseases with its award-winning blood analysis service. The thesis is done while working simultaneously as a full-time industrial designer in the company. This experience has allowed me to understand the company's goals and vision in a comprehensive way, through various projects tackling the world's health issues. The core idea for the thesis project arose while working with a product development project, involving a blood test. This project sparked the idea for the research; How to make this on average, painful and negative situation feel more positive using the physical attributes of the product?

(News.cision.com, 2019)

Thus, the objective of this thesis is to examine how positive emotions could be conveyed through physical objects. The goal is achieved using a study, investigating the possibilities to convey these emotions through eight sample objects. The aim is to provide new design methods for products involving unpleasant situations, such as a blood test. In the future The results may be utilized in design processes of the company.

The aim is to provide the company with new ideas on how to convey emotions through product design –this could enable products to have a higher impact on the target audience and end users. The secondary objective of the thesis is to provide concrete data to approach product design in a novel way. This kind of new approach could offer countless possibilities especially when designing products with significant impact and message, such as making people having a healthier life. The thesis introduces its reader the basics of psychological processes behind human emotions– utilizing psychology-based literature and in-depth conversations with psychologist Siiri Nuolioja.

While exploring the topic, it has become clear that the idea and methods behind this research are relatively novel– it turned out to be quite difficult to find relevant research. In fact, studying the basics of psychology, emotions, and processes behind emotions have turned out to be extremely valuable and necessary for this project. In my opinion, all this shows the unique value and position this project offers for the field of design.

1.1 Nightingale Health

Nightingale Health is a Finnish biotech company, focusing to find solutions for the world's most notorious health issues - chronic diseases, with its pioneering blood analysis technology. The technology can provide vast amounts of detailed molecular data from just a single blood sample. This process is why the data can be provided to the customer with relatively low running costs when compared to traditional blood analysis technologies. Nightingale health enables critical researchers and healthcare providers to utilize the latest knowledge while fighting the rapidly growing problem of chronic diseases. Provided metabolic data can offer countless possibilities in the battle against these rapidly growing worldwide health problems. Such as predicting the risk of developing a disease in the future, or to help improve one's overall health status. (Nightingalehealth.com, 2017)(News.cision.com, 2019)

I have been working for this company as an industrial designer during the thesis process. This experience has enabled me to gain insight into the industry, and understand the need for this research. Nightingale Health aims to develop products that will have an actual impact on the current health status of people worldwide. The need for these kinds of products is unquestionable. The severity and of these health issues is illustrated more thoroughly later (chapter 2.4)

Designing and developing products to tackle lifestyle-related health issues might be quite challenging. The main problem can be found straight from the word lifestyle. Solutions usually include significant changes in individuals way of life. This improvement might consist of such matters as diet, exercise, and stress to name a few. To make these changes possible, individuals need to have access to health information, to point out the problem. In addition to that, people need some tangible solutions and guidelines to follow and make a permanent lifestyle change. To make this whole process happen, individuals need to have the will to use products and services providing the possibility for a change.

The users will buy and use a product is one of the products critical elements I could influence a designer. In this case, the need for individuals to use Nightingale's products is undebatable, since the company could offer solutions to solve severe worldwide health issues. This research is one approach to examine how to enhance the positive impact on product experience.

1.2 The idea

Nightingale Health's core knowledge and expertise is blood analysis technology. It is only natural that products related to this service involve actual blood samples– the blood drawing situation always requires a needle, and skin to be punctured. Such conditions are at least somewhat unpleasant for the majority of people. The negative feeling varies, between individuals, from tenuous to almost irrational fear. It is common sense for a product which involves a needle puncturing the skin, raises on average more negative feelings than a product without a needle. This negative feeling can be as Since all the functions of Nightingale Health revolve around blood samples; it is of high importance to focus on designing a way to reduce the unpleasant experience of blood drawing.

The idea for the research was developed while receiving a design brief of a new product concept, involving a blood test. The test is performed by the user, without any assistance of a medical professional. It started to feel increasingly challenging to tackle the problems behind the user's experience, with this somewhat painful and uncomfortable situation. I began to consider different ways to address these presumably adverse situations through the attributes of the product itself. Physical features of the product seemed a potential target for this idea, in terms of impact and differentiation to other competitors. Thus, I decided to examine the psychology of emotions further. This idea ultimately led to the development of this thesis project.

After reviewing the idea, together with industrial designer Eetu Leppälä, we started to map possible ways to utilize this research in the product development process. I organized a workshop, where we outlined all possible emotions and feelings when a user performs the blood test. Usage of the product was described as a chronological path, divided with various action points. Probable emotions were placed on the usage path to show the correlation between certain action points and emotions. Negative emotions are positioned below the line using red bars, and positive on top, with blue bars (Figure 1). Negative emotions were perceived as something that could logically occur when performing specific steps of the usage. The positive emotions were perceived as attributes, which could help to ease the negative ones and make the usage of the product more pleasant.

As a result of the workshop was a set of determined negative and positive emotions, which could occur while using the product. Eight of the most significant emotions, containing four positive and four negative emotions, were chosen to act as a basis for the whole research project. I started to investigate the possibilities to convey the positive emotions through the physical attribute of the product. Thus, I decided to use the negative emotions to test if it is possible even to communicate the difference between positive and negative. The more detailed attributes of the objects were then investigated further using different methods. A set of three words were used to describe each of the eight emotions.

Because the product design project is confidential information, and a bachelor's thesis is a public document, this research needed to be separated from the product context. Therefore, I decided to try to convey these emotions through objects related to anything. This way I was able to test the idea and process behind the research, without having a substantial relation to the actual product.

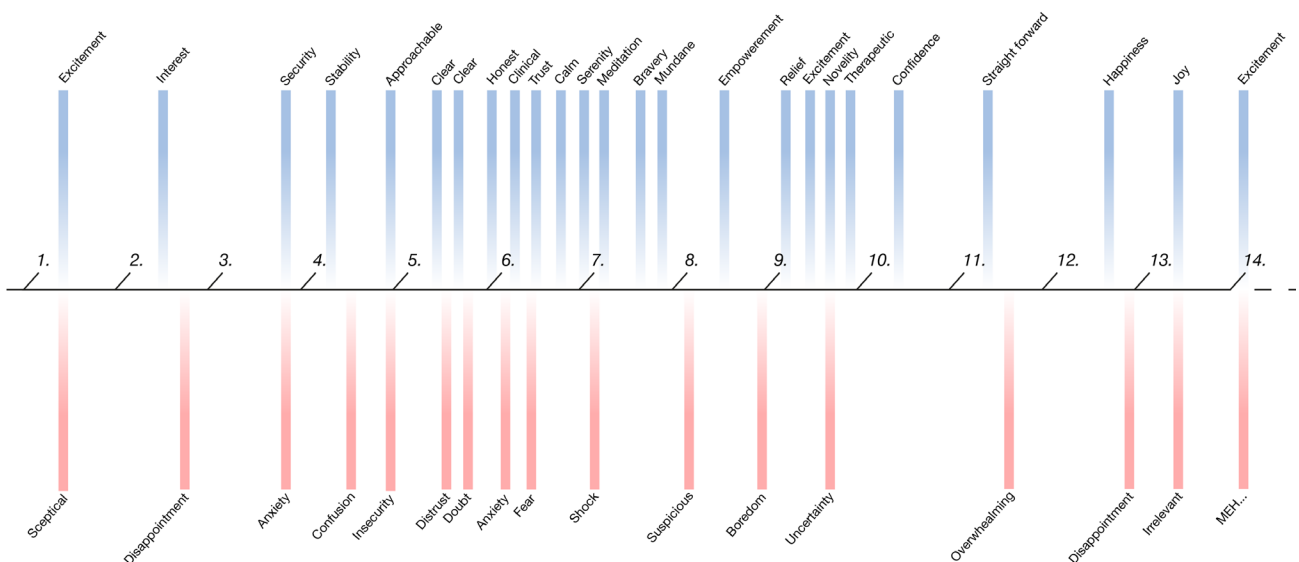


Figure 1

The illustration is picturing the usage path of the blood drawing situation. Numbers from 1 - 14 are communicating each action point of the process. The actual action points are replaced by numbers, due to confidential reasons. Red bars indicate negative emotions, blue bars positive. Each emotion is by descriptive word on top of each bar.

1.3 Research problem

The purpose of this thesis is to answer to the need for conveying positive emotions to individuals through physical products. This research introduces new way to answer this need, providing new ways of thinking. This is established through manipulation of material properties, such as form, weight and texture. Utilized design methods are created with the knowledge and ideas obtained from topic related background research. These ideas are tested with a quantitative and qualitative research, investigating if emotions and message are in fact conveyed using these methods.

The core problem behind the whole thesis research is defined as:

Is it possible to convey particular emotions with physical form, using psychological theories as the basis for the design?

The topic is examined through these supporting questions:

What psychological processes are involved in creation of emotions?

Is it possible to convey the difference between positive and negative emotion, through physical form of objects?

2. Introduction to the topic

The purpose of this chapter is to introduce the reader to the essential topics, related to this bachelor's thesis. This chapter also helps to answer the first of the supporting research questions. The first essential item is the basics of psychological processes behind emotions, and how they affect our behavior. Second main topic includes a brief introduction to chronic diseases and the problems they create. This topic is included to introduce the reader to the topics, related to product development of Nightingale Health, and to highlight the importance and need for such products.

In order to proceed reading this introduction to the psychology of emotions, it is of high importance to explain the difference of following terms behind the topic:

Emotions are complex psychological processes, describing personal sensations of individuals, towards bodily functions, and similar behavior to according situation. Emotions are best described as a heterogenous psychological category, containing various psychological phenomena.
(Encyclopedia Britannica, 2019)

Feelings are described as brief perceptions of physical events, experienced by the individual. Feelings are closely related to emotions, generally co-occurring.
(Encyclopedia Britannica, 2019)

2.1 Biology of emotions

According to Nummenmaa, all living creatures are equipped with processes to ensure individual wellbeing. Even the most primitive, single-celled organisms, such as protozoans, can recognize adverse environments from profitable ones. This small organism is capable of sensing environmental factors, such as the acidity and temperature. This phenomenon enables such organisms to act in the best possible way, regarding their own survival and wellbeing. In this case, the protozoan can move toward nutrients and avoid harmful surroundings. This division between adverse and beneficial surroundings could be seen as a primitive example of recognition between good and bad– the basic rule for all life on earth. (M. Diaz and Layborn-Perry, 2019)

More complex forms of life, such as fruit flies, are equipped with systems to ensure a more accurate way to avoid harmful conditions. Fruit flies can sense pain, among other informative neural signals to indicate the current status of bodily functions. Pain is an excellent example to demonstrate an effective way to notify the organism about physically threatening situations. When the fly lands on a too hot surface, its nervous system can sense this, and create corrective behavior, such as flying away. Later research shows that fruit fly can remember painful or harmful situations and avoid them later. Correspondingly, it is capable of recognizing beneficial situations and favor those in the future. (Gerber, B. et al. 2014)

Primitive protozoans evade too acidic solutions and move towards milder one, as well as fruit fly does not land on a burning hot surface or will seek sources of sweet scent. Both acting according to the underlying code of life: favoring good and avoiding bad. This phenomenon does not necessarily require any conscious actions from the organism. Naturally, protozoans or other primitive creatures are not capable of actual consciousness. Still, these same core processes between the choice of good and bad are comparable to animals, and even humans. (Nummenmaa 2010)(Nuolioja 2019)

2.2 Advanced creatures

Humans, similar than protozoans and fruit flies, act under the same rules than any other living organism. We must be able to recognize dangerous conditions from good ones and determine future actions accordingly. This division is one of the critical elements of human life itself. Evolution could have never happened without this division. Although it might seem slightly odd to compare the behavior of a fruit fly and human being, there are some definite connections, visible in our everyday life. We have similar systems that alert us when environmental situations turn against our wellbeing. Similar than the fruit fly, we are equipped with excellent systems that enable us to be alert of such situations at all times.(Nummenmaa 2010)

When placed in a cold environment without necessary protection, humans muscles will shiver if the bodily temperature drops too low. In addition to the physical response, we feel muscular discomfort. While experiencing this, humans are not able to consciously stop the shivers, nor the unpleasant feeling. This allows our body, and subconscious psychological systems to maximize the effort to act and change the situation for a more favorable one, such as warmer surroundings or improved clothing. This situation is related to the question between life and death. Conditions so crucial that it is more beneficial for us to operate without conscious acts or decisions to achieve needed goals in order to survive and prosper.(Nummenmaa 2010)

The former situation illustrates why emotional reactions are automated and can operate without any conscious elaboration or decisions. Our nervous system operates solely by receiving information from sensory cells, transporting data to spinal cord and brain, then creating actions when necessary. This is why senses are an essential part of all unconscious emotional processes. Without the sensory information, provided by the vast, vast network of specialized cells, emotions could not be engaged. Our nervous system is based on monitoring a vast amount of things with our senses, and adapt accordingly. Although efficient, this is not usually enough to maximize the chances of survival and wellbeing. (Nummenmaa 2010)(Nuolioja 2019)

2.3 Emotional behaviour

Although emotional experiences will, and have always been an essential part of humanity, they still keep shaking our world. They keep to shape our lives, and surprising over and over again. It is no surprise that such emotions have acted as a spark of creativity throughout history. Many artists, writers, and musicians have described those emotions in various ways. World-renowned rock band Coldplay (2005) described painful love as following:

*When the tears come streaming down your face
'Cause you lose something you can't replace
When you love someone, but it goes to waste
What could it be worse?*

In my view, creative interpretation through love songs, art, and poems are a perfect medium for describing the human emotional experience. Although thoroughly researched, psychological theories of emotional systems do not entirely cover the deep affect emotions arise in us. This fact is one aspect I see vast potential as a designer to grasp on. Feelings could offer significant benefits when included to design processes and thinking. First, it is necessary to ask why emotions have such a profound affect on us humans?

Emotions, in general, could be described as behavioral regulators. They exist to create and regulate specific behavior to achieve the best possible situation to survive both as individuals and species. The emotions are there to inform which situations are preferable and which of them we should to avoid. (Nuolioja 2019) These psychological processes enable us to do things necessary for the situation, without additional judgment and contemplating. An excellent example of these kinds of circumstances could be found when two people fall in love with each other. It is in our best interest to do almost anything to pass our genes forward. This phenomenon could lead to unexpected emotional responses in us, especially when the goals are not achieved. (Nummenmaa 2010)

It is highly relevant to distinguish the difference between emotion and emotional experience. Emotions are psychological standard processes, happening all the time; when we touch a surface, smell a scent or see movement, our emotional system creates a response of specific strength. The most important feature of this system is automation. The emotional system activates without conscious decisions, and We do not need any prompt actions to determine if something feels bad or something else. In most cases, we are not even aware that the emotional response also happened. Only if the response is strong enough, it reaches our awareness. When this psychological barrier has been passed, we consciously feel something. So emotions such as fear, love or happiness are psychological and bodily responses reaching awareness. These are the type of situations that can be described as feelings. (Nummenmaa 2010)

The emotional response is a state where human reach awareness of the current, for example, disadvantageous situation, since feelings are there to regulate and produce behavior, why would we even need to be aware of the situation? The answer is survival and our best interest. In these cases, our consciousness is a benefit and can help determine needed actions for the situation. So in addition to specific behavior, specific measures are also required. In these cases, mere fight or flight reaction is not enough, and we need intelligent decisions to contemplate next actions. Those actions might include plans on how to handle the negative situation in the best possible way. The conscious reflecting in these situations might result in unexpected negative feelings. This situation does not always happen when confronting life-threatening conditions. The same negative sensations are also related to loss of a pet, the bad grade from school, or having heartaches, to name a few. (Nummenmaa 2010)(Nuolioja 2019)

2.4 Chronic diseases

Chronic diseases have become the single most common reason for death and disability worldwide. Rapid spreading of chronic diseases is happening everywhere, regardless of socioeconomic classes or geographic location. These diseases include various conditions, such as cardiovascular diseases, type 2 diabetes, and multiple cancers. The World Health Report 2002 showed that chronic diseases are the reason behind nearly 60% of all deaths worldwide, and 43% of all diseases. The report also showed, that 79% of these deaths occurred in developing countries. This death rate is expected to rise to 73% as well as the disease rate to 60% by the year 2020. (World Health Organization., 2002)

The most notorious chronic diseases - cancer, cardiovascular diseases, type 2 diabetes, and chronic obstructive pulmonary disease, are preventable by biological risk factors, such as high blood pressure and cholesterol. These diseases are also heavily linked in behavioral health factors such as smoking and physical inactivity. A preventive approach could be an advantageous approach to keep these diseases from spreading. Preventive healthcare includes improving people's knowledge and habits towards a healthier lifestyle, thus preventing lifestyle-related diseases from happening. (Who.int, 2019)

For this change to happen, we need to know accurately about our current health status. Current methods involve physical bodily measurements, such as height weight and waist circumference. If healthcare professionals have a reason to suspect a risk of developing a disease, blood analysis is usually involved. A blood test is an exceptionally effective method for analyzing various health-related metabolic data. The current problem is the price and availability of available blood testing technology. Another challenge is what happens after the data has been analyzed, and the health information is communicated to the individual. Since lifestyle choices heavily influence chronic diseases, permanent improvement of health status requires permanent lifestyle changes.

I have learned, that permanent changes can be hard. Losing weight, reducing sugar or salt consumption are all actions on the to-do list of many people. This phenomenon is one of the critical problems with chronic, lifestyle-related diseases. Patients might be well aware of the necessary changes. This being said, behavioral patterns need to be changed in to achieve well-being and a healthier life. This is the reason; new measures are necessary to keep the individuals on the right track, towards a healthier lifestyle.

3. The research methods

Following research methods were chosen based on conversations with psychologist Siiri Nuolioja (Nuolioja, 2019). The insight gained from the ideation helped to create efficient, yet productive research with minimal communicational problems. In the case of words and emotions, communication might be a significant challenge. This fact is the main reason why quantitative methods were chosen to produce the data for analyzing the results. Some qualitative techniques were used to gain in-depth insight into the quantitative data. This way a change for verbal or written misconception was minimized. The chosen means also offered a possibility to gain a broader perspective about the topic. This process allowed me to understand the results in a more comprehensive way.

3.1 Study design

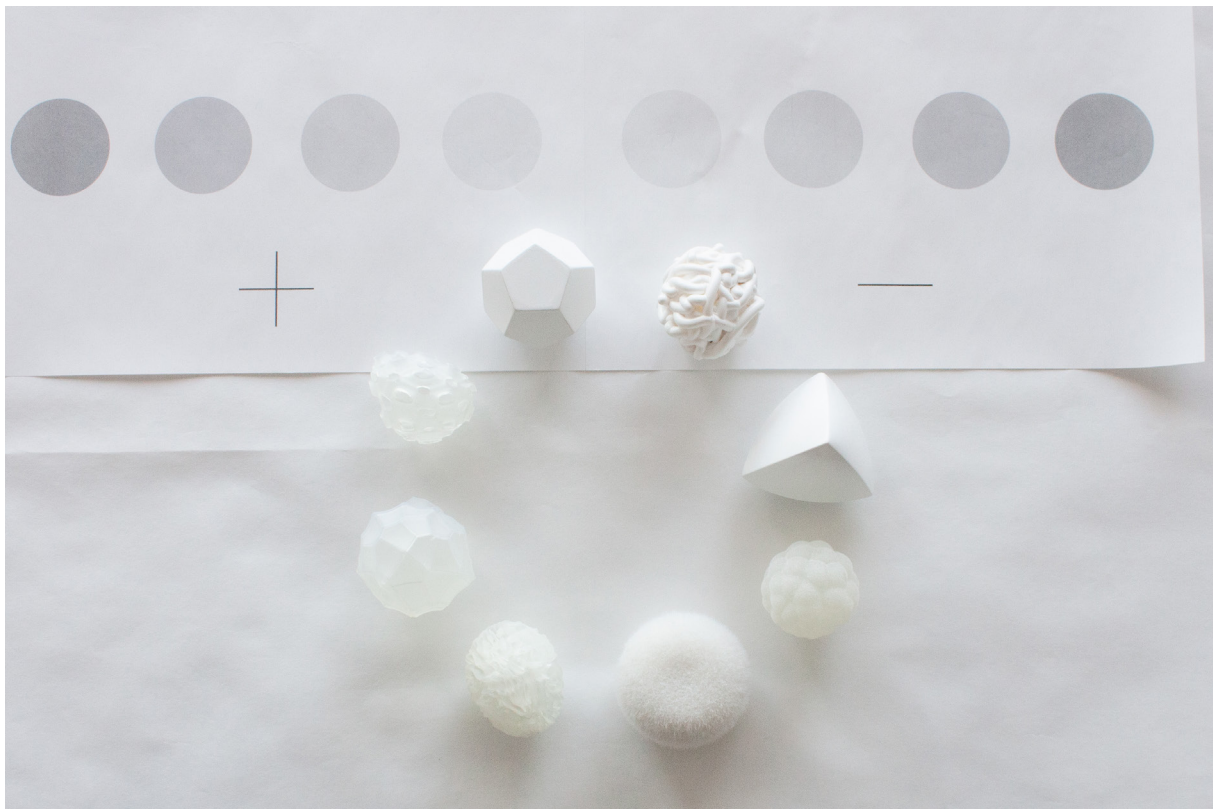
The study consisted of two different parts. The first part included a physical task and a questionnaire, to gather quantitative information about the topic. The second part was a brief interview, aiming to provide additional in-depth information about the subject, and the test situation itself. This study gathered 40 participants from various backgrounds. Half of the participants were employees of Nightingale Health and the other half students from the University of Helsinki. Participants were chosen from all age groups between 20 and 60 years and had various backgrounds from science to technology. Since there was no specific group of people to aim the results of the research too, the test subjects were not selected according to any particular rules or qualities. The study situation was held in a quiet space, individually with each participant. I was present in all of the research situations.

The study aimed to investigate how certain emotions could be conveyed to individuals. This intent was achieved by examining the psychological processes behind each emotion. These findings and gained knowledge acted as a basis for the creation of all eight objects (explained in chapter 4). This creation process was then tested using both quantitative and qualitative research methods.

The first part of the study setting included a task, given to the test subjects at the beginning of the research situation. All eight objects were placed in a circle formation in random order on a large sheet of white paper. This paper had eight circles in a row printed on it, the circles in both ends had a darker grey color, gradually lightening with each circle towards the center. The row was divided in half, with a plus and minus symbols (Picture 1). The graphics represented a scale from negative to positive. Darker color indicated a stronger emotion, and lighter a milder one. Test subjects were then asked to divide the objects into positive and negative ones — the darkest circle representing a strongest and the lightest a neutral object. The outcome was a row of eight objects, arranged by the test subject. This arrangement was then photographed for analyzing.

After the task, subjects received a paper with a picture of all eight objects (Picture 2). The images were printed in three random orders so that the order had a minimum effect on the results. Next, to each picture was a list of words in random order, the words were the ones describing each object(chapter 1.1), mixed. Test subjects were then asked to highlight three words from each list, to describe the object. Participants were not aware of the connection between the words and the objects. Participants did not receive other guidelines on how to choose the words from the list.

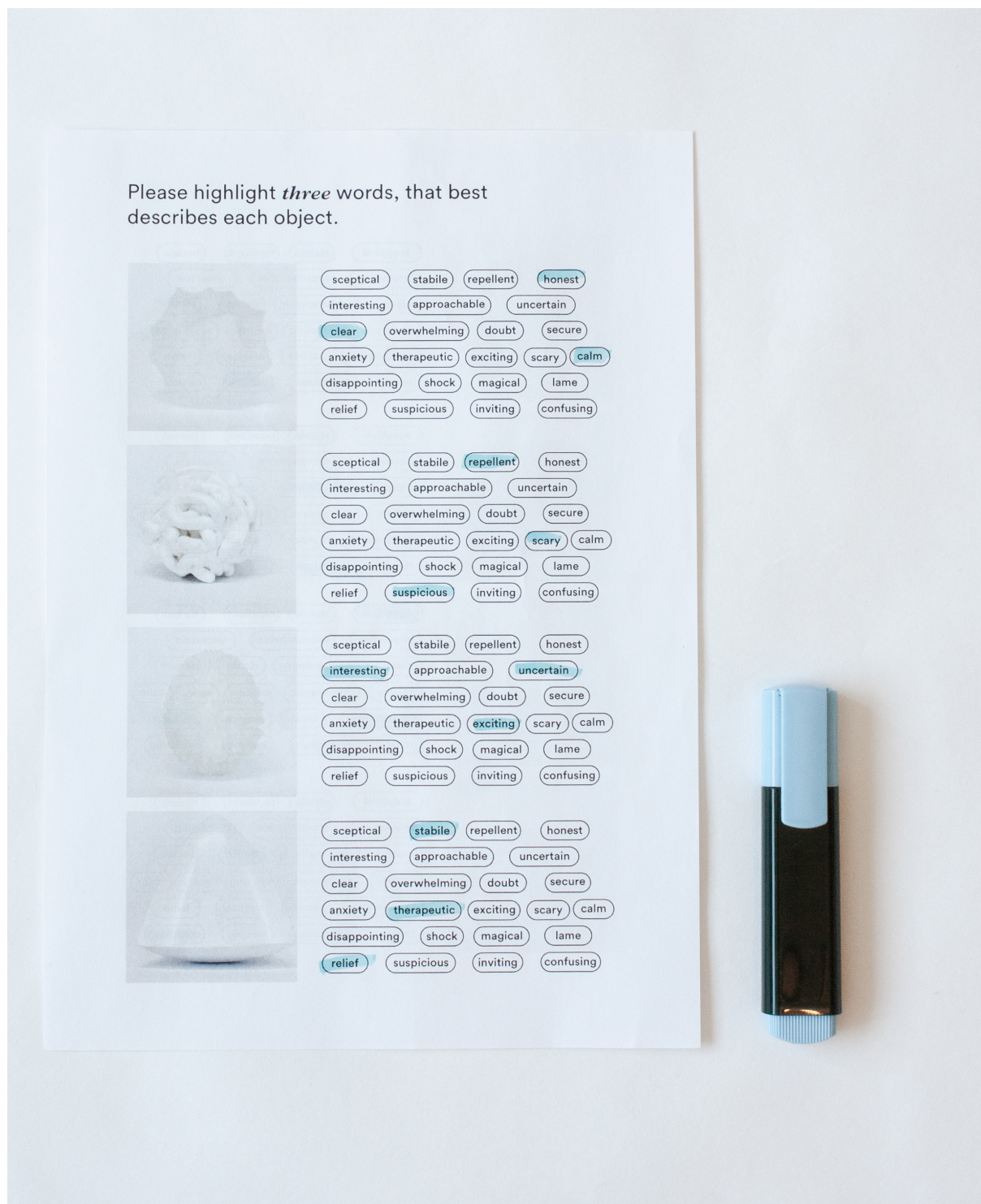
The final part of the research was a brief interview with each participant. The interviews followed no apparent structure. Each participant was asked if the tasks were hard, and how to felt about the situations. If the conversation went naturally towards an explanation behind the choices, the interview was continued. If the participant did not continue the conversation naturally, the test was considered done. This choice was made because of feasibility. Especially in a busy office environment, during working hours. I chose to require no more than 10 minutes to complete the study. If the test subject willingly stayed a more extended period, it was considered to be a substantial extra. All of the interviews were recorded by the interviewer, ranging between two minutes to almost one hour. Records were analyzed afterward. Annotations were made during all of the research situations; these notes included various comments by the subjects and general observations about the case.



PICTURE 1

Grey dots illustrate the scale from positive to negative. The lighter ones on the middle are representing neutral votes. darker ones the stronger feelings.

The object were positioned on this arrangement, before each participant. The order of the objects was mixed after each participant, so that the bias caused by the arrangement order would be as minimal as possible.



PICTURE 2

The questionnaire form. each object is presented with a picture. Next to each object is a list of words, where participants were asked to highlight three words to describe each object.
The order of the objects varied in the forms, to minimize the bias, caused by the order.

3.2 Data collection

The derived data includes a set of 40 pictures from the object arrangements, filled forms, and vocal recordings of the interviews. The choices made in the arrangement task is translated into an excel sheet (Figure 1), including the ranking of each object, of all 40 subjects. A scoring system was used to communicate the classification in numeral form. The highest negative and positive rankings received 3 points each, next ones received 2 points, and the following ones 1 point. The two objects in the middle gained both 0 points. This data can be utilized to analyze the divisions with different methods. In this study, the data were transformed into two bar charts, representing the numerical data in a visual form (Chapter 5.1)(Figure 2, 3).

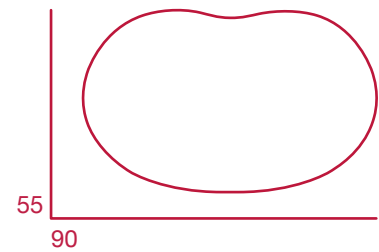
The word lists, describing the objects were analyzed, using word clouds. The words chosen to each object was written to a text file. This text file was transformed into a word cloud (Chapter 5.2) (Figure 4), highlighting the most common words with size and the darkness of the black color. This allowed a simple way to communicate the most popular choices through visual information. The recorded interviews were analyzed with annotations and transcribing software, to form a comprehensive picture of the whole situation.

The study settings were chosen, based on the feasibility, efficacy and communicational aspects of the topic. Research setting with both quantitative and qualitative elements was selected to cover the issue as widely as possible. Due to the production time and feasibility, qualitative side helped to gain insight into the data, gathered with quantitative methods. Also, the topic required in-depth methods to obtain meaningful results.

4. The objects

This chapter will introduce the eight objects, reflecting emotions described in previous chapters. The current chapter includes an introduction to the core ideas, design process as well as the manufacturing of each object. All of the objects are presented individually, explaining the details of that particular case. Since all objects are equal, there are no names or other sorting systems for them. From this point forward, objects are given names, due to Greek alphabets. The names have no relation to the content, or the objects physical appearance, and exist only for communicational purposes. The objects are represented later through names and small icons, to identify each object while reading the text.

4.1 Alpha



Keywords for the creation:

Relief

Therapeutic

Calm

Materials used:

Formlabs UV resin 3D print

White sand

Nylon flock fiber

Acrylic glue

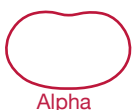


PICTURE 3
Object alpha

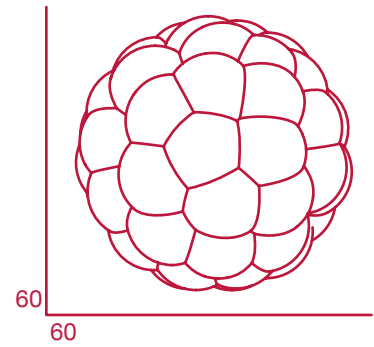
The purpose of this object is to catch the essence of the feeling when holding something precious and vulnerable. Alpha weight is similar to a newborn baby's head, or a small animal, such as a guinea-pig or a bunny. The object also features a soft fur-like fibery surface, that creates an interesting sensory sensation when handled. These attributes are related to our primitive instincts, reflecting similar feelings and emotions as taking care and holding a small pet or an infant baby would.

The starting point for designing this object was the haptic feeling. The challenge was to create a sense of calmness with almost therapeutic elements. According to some research, taking care of something living, such as a child or pet arouses strong positive feelings in humans. (Nummenmaa 2010) This idea was the reasoning behind the certain weight and the soft surface texture of the object. The shape of the object features a sleek form, with a dent in the middle. This dent is perfect for placing thumb when holding the object in one hand. The object weighs 300 grams. Alpha has a solid white appearance that reduces uncertainty towards the object, allowing the handler to enter into the feeling comprehensively.

I started to sketch soft organic, yet simple base form for the object. I tried to find a balance between simplicity and ergonomic qualities. Around, a flattened sphere with a dent on top was chosen to be the final form. This object was then modeled using Rhinoceros 5 with a simple three-degree curve, and a revolve command. Material thickness and modifications for printing were made with the same software. This object was 3D printed utilizing Fomlabs UV resin printer. A transparent and hard resin was chosen as material, in order to achieve the best possible surface finishing possibilities in addition to this. I coated the whole object, using an electric current flocking technique. Before this bachelor's thesis project this technique was entirely unfamiliar to me. The technique enables loose fibers to attach to the glue-surface, according to the electric field, applied to the surface. This allows the fibers to form a uniform fur-like texture. Although the technique is relatively simple, it took multiple times to coat the surface successfully. Long nylon fibers allowed the object to have uniform fur-like texture, resembling something organic and living.



4.2 Beta



Keywords for the creation:

Approachable

Clear

Inviting

Materials used:

Formlabs UV resin 3D print

Nylon flock fiber

Acrylic glue



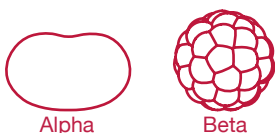
PICTURE 4
Object beta

This object aims to invite to touch. Beta captures the essence of low threshold approachability. The physical appearance of the object is a carefully considered balance between organic and computational forms. The object resembles slightly a berry or fruit, thus communicating primal appeal to approach and examine. (Nummenmaa 2010)

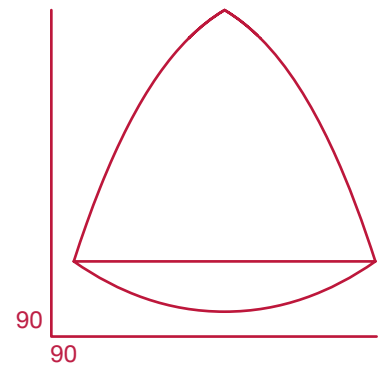
The starting point for the design of this object was the visual appearance, and the feeling when touching the form of the surface. According to multiple studies, humans love for sweet foods is part of our primate heritage. The sweet, colorful fruits which our ancestors found in trees was a crucial part of our species survival. The natural appeal for sweet is coded in our bodies. (BBC Science, 2013) This idea was the most critical driver for designing Beta. The word clear is conveyed through clean geometric form and uniform appearance. These attributes are communicated in this case through form and haptic feeling of the object, leaving scent, color, and taste intentionally out of the appearance.

I started the design of this object, by sketching different organic fruits and shapes. I moved quite quickly to model these shapes with Rhinoceros 5 and its Grasshopper add-on. I decided to use a relatively simple algorithmic definition, producing a sphere, with its surface populated with smaller spheres. The spheres were united to create a closed object. Separate mesh modeling software was used to create material thickness, and modify the object for improved printing quality. This object was then 3D printed using Formlabs UV resin based printer. A hard clear UV resin was chosen, as it enables multiple possibilities for various surface finishes and colors.

At this point, I decided to utilize the same electric current flock coating technique as I did with the manufacturing of the previous object. In this case, shorter and softer nylon fibers were chosen, to illustrate soft surfaces found in various fruits and berries. I also preferred the object to be seen as velvety and soft, rather than fibery and hairy.



4.3 Gamma



Keywords for the creation:

Security
Stability
Honest

Materials used:

PLA filament- 3D print
White sand
metal balls
neodym magnets
paint



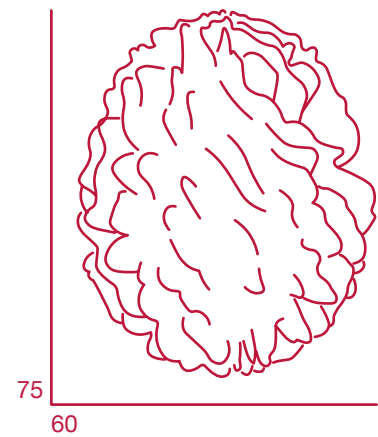
PICTURE 5
Object Gamma

Gamma reflects the nature of stability and solidity. A three-sided pyramid form, with slightly rounded faces, was chosen to be the final form of the object. This shape relates to the feelings this object represents. Stability is communicated, using triangles as the primary form. Triangles are considered to be structurally the strongest and most durable of geometric forms. Gamma's geometry is based on this piece of knowledge. The object's shape is a three-cornered pyramid, with slightly curved faces. This form creates a sense of durability and stability. This object features surface with solid, glossy and hard appearance. Clean geometric form and sleek clear surface finish enable the feeling of trust and durability. This object also weighted bottom, allowing the object to stand in the right position at all times. It also has three neodym-magnets, hidden inside. These magnets enable slight resistance, while lifted from the metal surface. This effect accentuates the feeling of stability and durability. The design choices made for this object were determined from discussions with psychologist Siiri Nuolioja (Nuolioja, 2019)

This object was made based on a series of sketches. Modeling was made with modeling software Rhinoceros 5. Gamma was modeled using only one two degrees NURB curve as a base form. By rotating and copying this curve, allowed me to build the form around this network of curves. This process highlights the geometric coherence of the object. The object was 3D printed using Ultimaker 3 Printer with white standard PLA filament. The printing was done in two separate parts. The lower part of the object was filled with sand and three neodym-magnets before gluing the two parts together. Gamma was then sanded and painted with glossy white acrylic based paint to achieve durable and high-gloss finish.



4.4 Delta



Keywords for the creation:

Excitement

Interest

Magical

Materials used:

Formlabs UV resin-

3D print

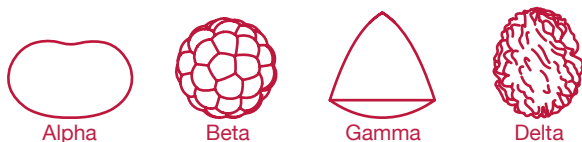
paint



PICTURE 6
Object Delta

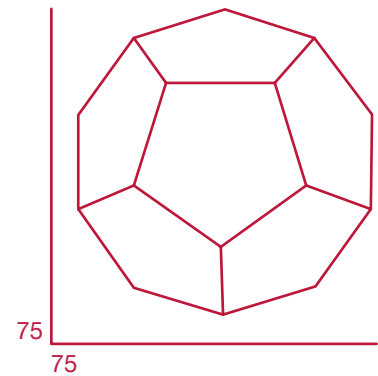
According to a theory by Miller (2001), an object that arouses excitement is primarily a reflection of its creator. When an object, a piece of art, or a product seems interesting or beautiful, humans tend to see the object as an extension of the person or entity behind it. The individual then compares one's skills and knowledge to this creator. If those individuals own skills are exceeded, the object and its creator will seem more favorable in the eyes of the individual, gaining positive emotions, such as admiration and interest. This phenomenon is visible in human-made matters, such as in art and design. Alternatively, objects saw in nature, such as in intricate seashells or pieces of rock. This idea was the basis for the design of this object. Delta features organic form and appearance with a certain level of computational control. The surface structure resembles a seashell or some other aquatic creature. The basic form of the object is an ovoidal shape, referencing to rocks, coral skeletons or other organic objects. This ovoidal curve allows the object to have some level of control, remaining seemingly organic.

I already possessed one potential idea at the beginning of designing this object. Since I realized the connection between emotions and organic-oriented objects, such as corals, the modeling software Grasshopper seemed useful for this situation. This software allowed me to use algorithmic tools to mimic these natural forms and shapes. A reaction-diffusion pattern algorithm created Delta's coral-like appearance. I have used this same technique before in Algorithm aided form giving -course, where I was introduced to the usage of Grasshopper and Algorithm aided design. After Grasshopper, I used separate mesh-based modeling software to create a printable object with surface thickness. This object was printed using Formlabs 3D printer. A clear and hard resin was chosen to achieve a translucent appearance. After finishing the print with different sanding methods, I painted the inner walls of the object white. This material accentuates the semi-translucent finish and adds a layer of curiosity to the object.





4.5 Epsilon



Keywords for the creation:

Disappointment

Sceptical

Lame

Materials used:

PLA filament- 3D print

spray filler

paint



PICTURE 7
Object Delta

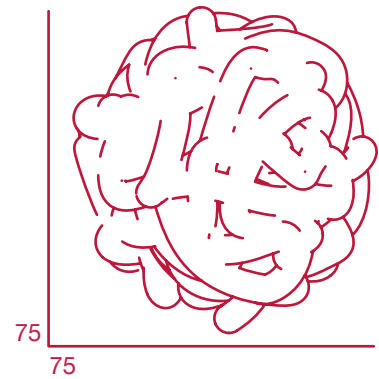
The object's physical appearance was solely determined after talking about the subject of emotions and disappointment with psychologist Siiri Nuolioja. (Nuolioja, 2019) When a subject is experienced as disappointing and lame, the specific goals of the individual has not been met. The feeling of disappointment is primarily a reflection of previously formed expectations to reality, which the subject has just encountered. In his case, these expectations are created through the first encounter of the object. When an individual encounters this, or any other object for the first time, a certain preconception is created. This preconception happens before more detailed exploration. The individual then validates these attributes through an actual examination of the object. If the expectations are not met, a feeling of disappointment occurs.

Epsilon's geometric shape is a dodecahedron, a polyhedron with twelve flat faces. This shape was chosen due to its generic, non-deviant form, which follows a precise mathematical structure. This process facilitates the individual to experience the object as something familiar and comfortable to comprehend when first encountering the object. In addition to the physical form, disappointment is conveyed through weight and material feel of the object. Epsilon weighs 40 grams and is made of painted 3D printed PLA plastic. The aim of this material combination and weight is to offer little to no haptic surprise when handled. This material choice highlights the general feeling of the object, especially when it is compared to other objects.





4.6 Zeta



Keywords for the creation:

Anxiety

Doubt

Uncertainty

Materials used:

PLA filament- 3D print

Paint



PICTURE 8
Object Zeta

The idea behind the creation of this object is the definition of confusion itself (Dictionary.cambridge.org, 2019):

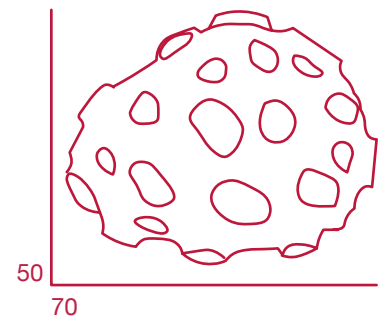
a lack of understanding, or a state of disorder.

The goal was to create an object which features little to no attributes for attention to grasp on. Something that seems hard to categorize and determine. This task was most difficult of all eight objects. In addition to confusion, the object needed to have attributes reflecting the words suspicious and overwhelming. In my mind, these qualities can be found in nature derived objects, such as in the case of the object Zeta. This is why I chose to create something with an uncontrollable organic feel. The basis for the creation of Eta was in the ostensibly organic structure, generated with algorithm aided 3D modeling methods. This process enabled the object to have irregular, uncontrolled characteristics, reflecting organic attributes.

The creation started with sketch different organic structures and ideating different algorithmic definitions, which was utilized in the creation of the object. After some iterating, Eta was created using 3D modeling software Rhinoceros 5, and its Grasshopper add-on. A relatively simple definition was utilized to populate a sphere with random points and creating NURBS curve through them. A pipe structure was then generated around this curve. The object was sliced using Cura software, and 3D printed with Ultimaker 2, using standard white PLA filament. The object is printed with 100% infill; this creates a heavy, solid feel when handling the object. In my mind, this creates a feeling that the pipe continues inside of the object, rather than being only an outer shell. The finishing touch was to paint Eta with glossy acrylic paint, to highlight the organic appearance. I hoped this finish accentuates the solid feeling when handling the object.



4.7 Eta



Keywords for the creation:

*overwhelming
suspicious
confusing*

Materials used:

Formlabs UV resin 3D print



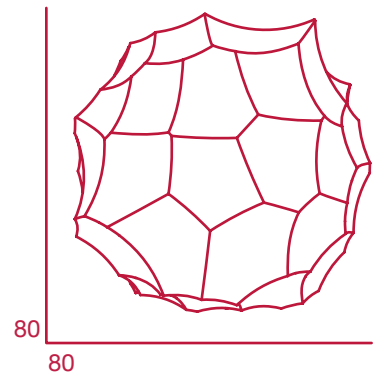
PICTURE 9
Object Eta

According to a research, conducted by Geoff Cole and Arnold Wilkins of the University of Essex (Cole and Wilkins, 2013), fear of holes– or Trypophobia is more common than previously thought. The research showed that tryphobic tendencies might have an evolutionary explanation, due to the connection made between harmful organisms and surface patterns with holes. According to the researchers, everyone has these tendencies, although only some are aware of them. This idea was the basis for the creation of this object. Zeta features a hole filled an organic form, which seems to follow no clear structure or set of rules. This process creates an ostensibly organic object, that aims to deliver negative feelings, such as anxiety, doubt, and uncertainty. Similarly, as some nature derived organic objects would.

Zeta was created using mesh-based 3D modeling software Blender, and its add-on called tissue. This piece of software offers useful tessellation tool, enabling the creation of seemingly organic, hole filled surfaces. Although utilizing algorithmic from creation, Zeta is the only object of the eight following no geometrically clear base form. The form was created using mesh based polyhedron sphere with twenty faces, deformed with blender’s mesh sculpting tool. This object was made using Formlabs 3D printer with transparent resin, to create semi-transparent, tissue-like obscured finish. In my point of view, this accentuates the organic and fragile appearance, adding intensity to the perforated surface structure.



4.8 Theta



Keywords for the creation:

Repelling

Scary

Shock

Materials used:

Formlabs UV resin 3D print

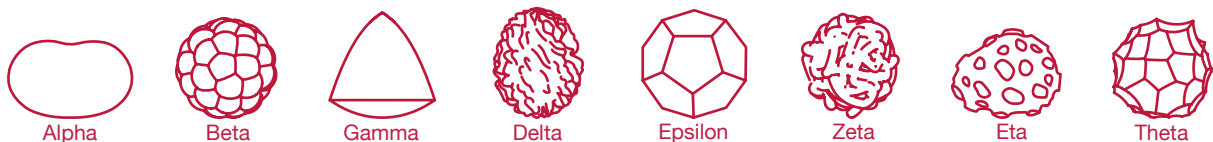
Acrylic glue



PICTURE 10
Object Theta

The starting point for this object was the material feeling when holding a fragile piece of plastic or glass. The task was to mimic this sensation with more durable material. Another aspect behind the idea was to create something imitating potentially harmful situations, such as sharp or spiky objects, without actually inducing any pain or other unpleasant physical sensation. Fear is something that is coded in our brain's limbic system, thus being one of the most fundamental and vital feelings humans, and other living organisms have. Still, a significant part of the origin of the feeling fear is learned during life experiences. Providing something that even remotely resembles a potentially fearful situation, can trigger the response in our brain. (Tsaousides, Ph.D., 2015) These subtle attributes were the idea behind inducing this emotion through Theta.

The design process of this object started with sketching different shapes directly with Grasshopper. The idea for creating this object was established while generating Beta (chapter 4.2) I realized that The bubbly shape could be utilized, to create a negative form, from the inner surfaces of the form (Beta). Theta was then generated with this exact method, utilizing boolean commands to separate the forms from each other. The result was a spiky sphere, with irregular faces. The spikes are pointy enough to create an idea of spikes but obtuse enough not to create an uncomfortable sensation while handled. Theta was manufactured using Formlabs 3D printer, with a transparent hard resin. This material allows the object to have a fragile and transparent appearance, still obtaining a proper material strength.



Nb!

The following chapters contain discussion and evaluation of the eight objects. The discussion is conducted, using only the names of each object. Thus, from this point onward, these small icons are included to represent every eight objects to assist the reader in the text.



Alpha



Beta



Gamma



Delta



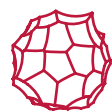
Epsilon



Zeta



Eta



Theta

5. The results

This purpose of this chapter, and quantitative data presented, is to answer the research question; Is it possible to convey the difference between positive and negative, with physical form of objects? This data is presented, using a table and graphs, explaining the collected information, and results.

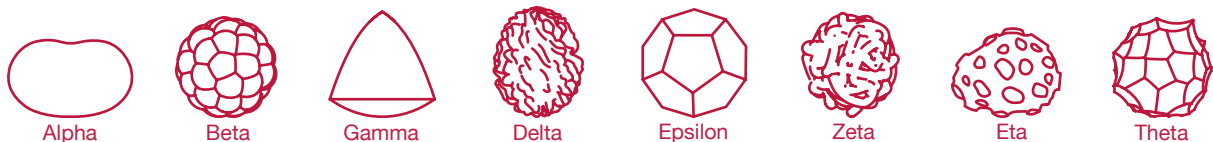


Picture 11
All 40 divisions by the test subjects

The current table (Figure 1) represents each subject's arrangement of objects to the scale of positive and negative. Each object is presented through two rows, one for positive classification and one for negative. Columns ranging from 1-40 represent each of the forty subjects. Each of those cells contains a number between 0 and 3, 0 being a neutral classification while 3 representing the extremes. The five final columns are formulations, containing functions to analyze the data. W/,0 represents the total positive classifications excluding neutral zeros in each row. The second column calculates the total of all answers, including zeros. The following columns calculate the total quantity of a specific value, such as how many times number 3 was chosen. Even though the 0 indicates a neutral feeling, it is still placed in either a positive or a negative row. This choice was made after analyzing the interviews and annotations of each participant. Since only a few participants felt that the objects in the middle were utterly equal among one another, it was reasoned to place the answers in either positive or negative row, according to each subject's choice.

[illegible]

Figure 1
Table containing the division results in a number form. The
Cells after 40, contain functions calculating the results.



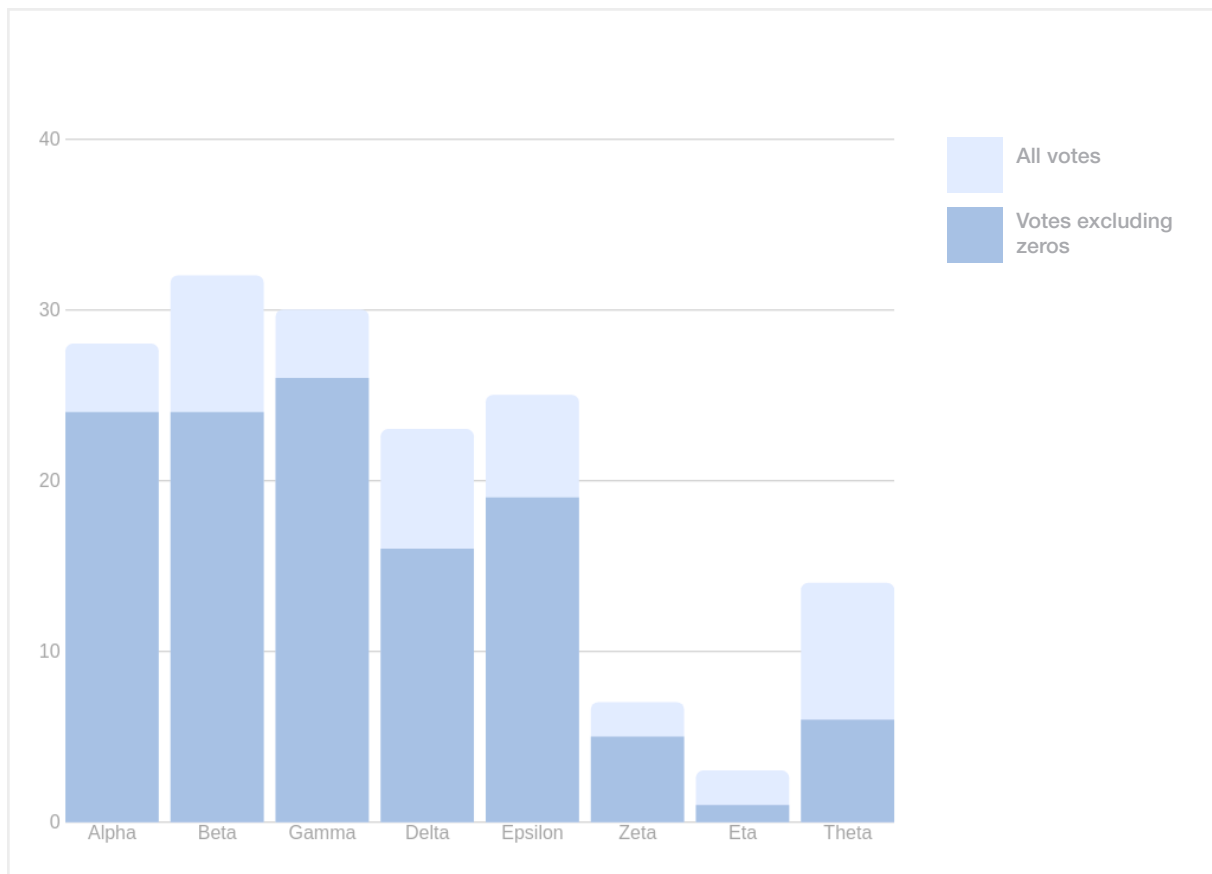
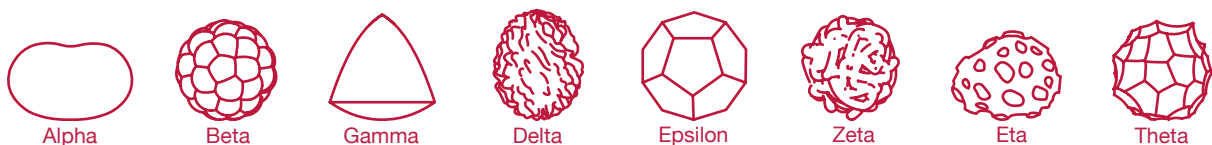


Figure 2
Bar graph indicating the positive scores. Darker blue indicates votes only with numbers 1, 2 and 3. Lighter blue contains the additional neutral 0 votes.

As figure 2 shows, objects Alpha, Beta, Gamma and Epsilon were ranked as the most positive objects. When taking account, both total classifications including and excluding neutral zeros. Three of those objects were intended to convey as positive, and one as negative. Object Epsilon was the only one that was supposed to appear as a negative one. That being said, as it is clear examining figure 2, Delta and epsilon had only minor differences in the ranking. Both of them received quite a high number of neutral zeros, and had only 3 participant difference, excluding zeros. Alpha, Beta, and Gamma all received a high ranking in positivity, both with neutral votes and without. Gamma was experienced as the most positive object, and it also received a relatively low quantity of 4 zeros in total. The difference between Alpha and Beta is challenging since both of them received 24 positive ratings. Beta received more neutral votes than Alpha, with an amount of eight zeros. Alpha received four zeros in total. On the other hand, Alpha received more negative ratings than Beta.



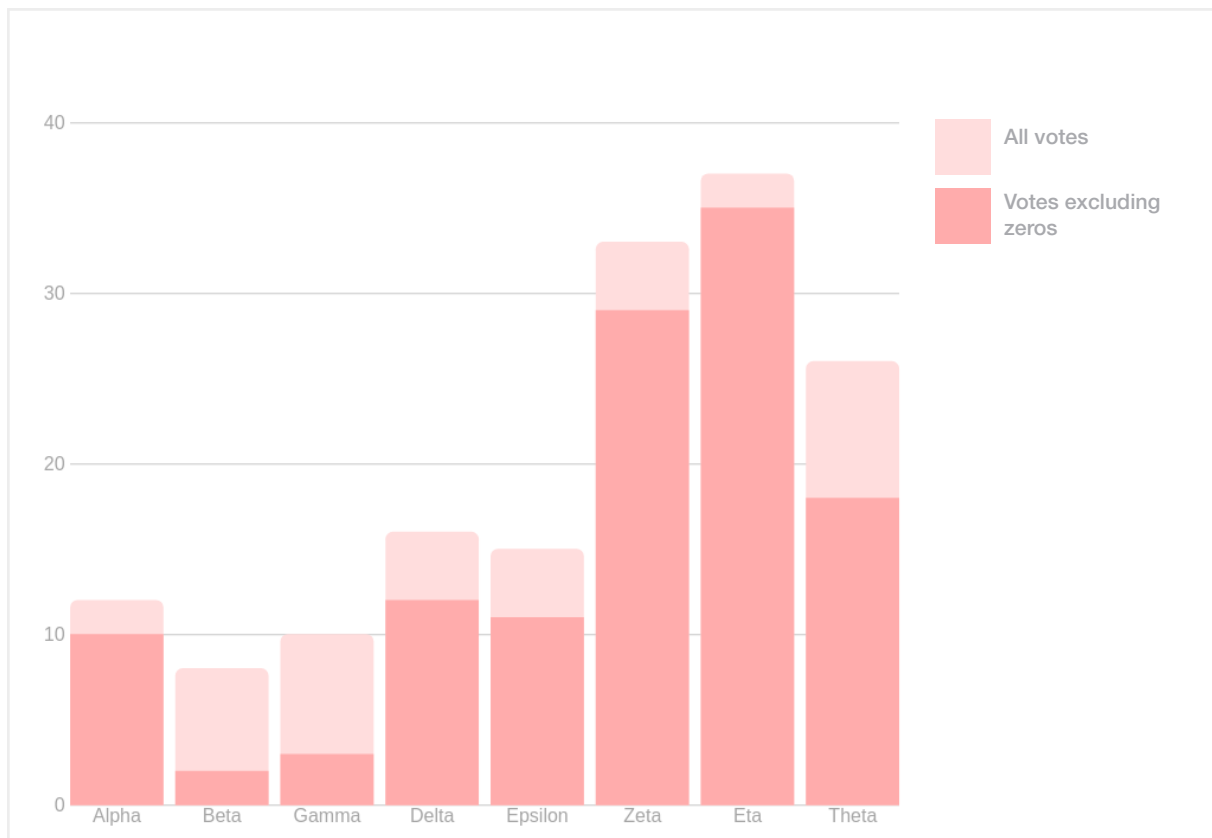
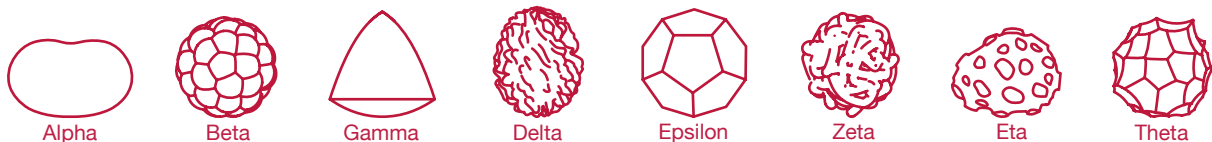


Figure 3
Bar graph indicating the negative scores. Darker red indicates votes only with numbers 1, 2 and 3. Lighter red contains the additional neutral 0 votes.

According to figure 3, objects Theta, Eta and Zeta were categorized as the most negative ones. Eta received highest negative rankings both with negative zeros and without, it was ranked in among harmful objects 37 times, which contained just two negative zero rankings. The difference of four votes then followed by Zeta, both of these objects received an unusual amount of highest rankings of number 3, compared to Theta, which received mainly rankings of 1 or 2. None of these three objects received significant amounts of favorable rankings. Epsilon intended to be an object with negative attributes; according to results, it ranked as more of a neutral object rather than a negative one. Same happened with Delta, which turned out to rank similarly neutral, as did Epsilon.



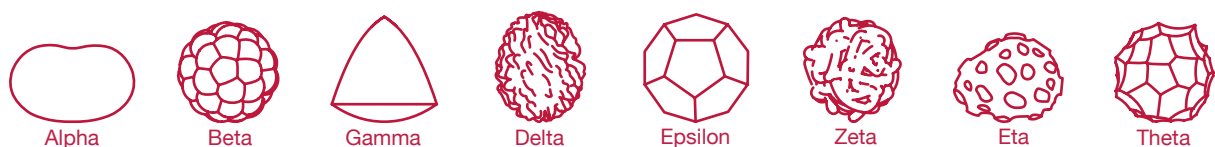
5.2 Word clouds

Next figure (FIGURE 4) represents the data derived from the list of words, and descriptions subjects made during this second task. Each object is represented with a picture, next to each image is the same list of words, received by the participants. The correct three words for each object are highlighted with a light blue color. Next to the list is a word cloud, representing the answers test subjects chose. The size and darkness of the words describe the number of responses. This method allows me to investigate if the actual 3 words behind each object were conveyed to the participants. The process also allows further examination of descriptions and subjects thoughts of each object.

Some objects received a significant amount of the same words. They originally were designed to reflect. Interestingly, some of the objects received a negative ranking in the previous task (chapter 5.2) but were described with more positive words in the second one. According to the results, Alpha was seen as Inviting, approachable and therapeutic. Since the original words were; Therapeutic, relief and calm, the results seem promising. Beta was described as similar words: Interesting, approachable and therapeutic. Since the original message behind both of these objects was somewhat similar, these results could be seen as successful.

Gamma received calm, clear and stable as the three most significant words. Honest and secure were followed after these words. Object Delta was described as; Interesting, exciting and magical. Those were the three exact words behind the creation of the object. Because of this and since all of the original words are included in the descriptions of both objects by the test subjects, these results were successful also. Epsilon Received words; Clear, stable and lame. Two of the words did not describe the intended attributes, results containing only one word that was designed. Zeta received words; Repellent, suspicious, and confusing, following by other words, describing the same general feeling. This object had two words from the original intention, chosen by the participants.

Eta was described as; uncertain, interesting and confusing. The original words included overwhelming, and questioning, both of which could be seen as describing almost the same as uncertain and confusing does. Since the purpose of this study is to examine emotions, these results can be considered successful. According to the results, Theta was described with more than three significant words. Those words included: repellent, anxiety, suspicious and. The results contained the same words than intended again; in addition to that, other chosen words can be seen to describe similar attributes. Similar to earlier objects, the results of the final two can be seen as successful.





calm
therapeutic
relief

interesting clear
approachable uncertain
secure anxiety
therapeutic honest
confusing
overwhelming inviting doubt
scary lame
calm suspicious sceptical
relief stabile
shock repellent
disappointing
exciting
magical



clear
inviting
approachable

exciting magical
clear
confusing
inviting doubt
uncertain
sceptical calm stabile
interesting
suspicious lame
scary relief
repellent therapeutic
secure honest approachable



honest
stable
secure

secure stabile
uncertain
approachable
sceptical
therapeutic doubt
calm magical
suspicious relief inviting
honest lame
interesting



magical
interesting
exciting

overwhelming
exciting
shock honest repellent inviting
confusing scary uncertain
approachable anxiety
interesting
magical
stabile calm
disappointing therapeutic
sceptical suspicious
doubt

Figure 4 1/2
Wordlists, derived from the an-
swers of the participants.



sceptical
disappointing
lame

disappointing
stable
uncertain approachable
confusing honest
magical clear
relief doubt anxiety
repellent interesting
calm lame
therapeutic
secure



doubt
anxiety
uncertain

sceptical confusing
interesting
relief lame doubt
overwhelming magical calm
uncertain
scary suspicious
repellent secure exciting
shock anxiety
honest inviting clear



suspicious
overwhelming
confusing

interesting
sceptical
lame shock therapeutic
uncertain calm
repellent anxiety
approachable scary
doubt inviting magical
disappointing exciting
confusing
suspicious



repellent
shock
scary

suspicious
interesting
anxiety disappointing
inviting shock magical
sock lame
repellent
exciting sceptical
doubt
scary overwhelming
confusing
uncertain

Figure 4 2/2
Wordlists, derived from the answers
of the participants.

5.3 Interviews

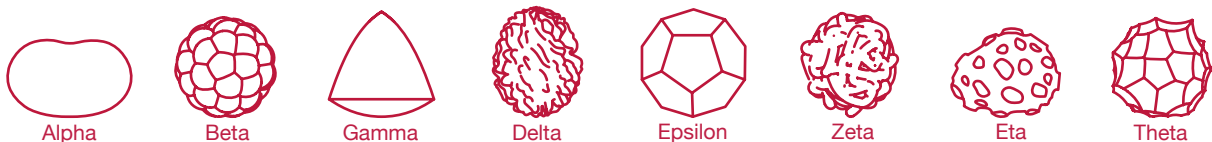
Interviewing the subjects helped to gain a comprehensive picture of the topic. I felt it was necessary to use qualitative data gathering in addition to previously presented quantitative methods. Interviews lasted from 2 minutes to an hour, ranging between a few brief questions, to a more comprehensive in-depth conversation about the topic. Interviews had no specific structure or guidelines, excluding a couple of questions.

All of the participants were first asked a question; “Did the given task felt easy?” And; “Was there any difficulties regarding the division, or the wordlist?”

80% of the participants felt that both the division and choosing the correct words was natural. Some participants would have wanted to add additional descriptions when starting the task, but thought that it was unnecessary after a brief moment. Almost all test subjects felt that the words made the feelings behind each object easier, thus making the division of the objects easier too.

Majority of the subjects felt that the difference between positive and negative objects was clear and straightforward, some part of test subjects stated that the neutral ones on the middle did not have any difference regarding positive and negative attributes. All participants found the division between the other six objects easy to do. A minor part of the subjects stated that the division was made according to a clear division between a geometric and organic appearance of the objects. The most organic objects were placed as negative ones; more geometric shapes were ranked as positive.

Over 50% of the participants explained the division and feelings further. These interviews lasted over 10 minutes, a few of them up to one hour. During these conversations, test subjects explained why certain choices were made and what feelings occurred when handling each object. Surprising comments were made during these conversations; this helped to shed light to decision process and feelings objects arose. One interviewee described object Alpha as; “Looking exactly like mold growth.” Other participant saw the object as; “lovely and cute.” These kind of comments were particularly notable since Alpha received both positive and negative ratings. Moreover, since the topic is related to emotions and feelings, this kind of qualitative information helps to form a comprehensive picture of the results.



6. Conclusions

The core problem behind the whole thesis research was defined as:

Is it possible to convey particular emotions with physical form, using psychological theories as the basis for the design?

The topic was examined through these supporting questions:

What psychological processes are involved in creation of emotions?

Is it possible to convey the difference between positive and negative emotion, through physical form of objects?

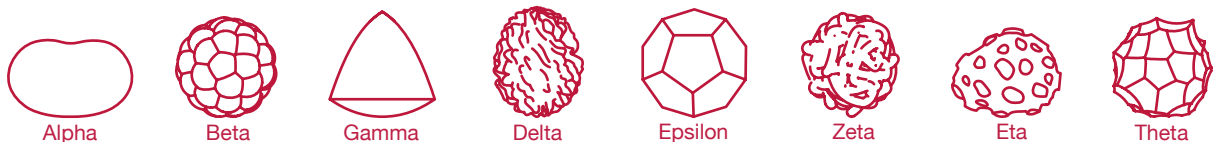
6.1 Discussion

The objective of this thesis was to provide some concrete methods and thinking processes to benefit Nightingale Health for specific product design purposes. Although the aim was to have something concrete that could be utilized, the emphasis of the research was in the thinking process, rather than actual physical attributes and details for future products. This decision was made partly because of the lack of context. This research did not focus on a specific product with characteristics related to usage. The study focused on gaining knowledge about the topic towards the creation of new design processes, where emotions could be taken into account. Although the emotions examined in this study were derived from a specific product case of Nightingale, the physical objects did not have any reference to an actual usable product. Thus, lacking the usage related factors. This decision was made due to the confidentiality of product development. The current chapter will explain the results of the research, and how they can be utilized to answer the research problem.

The quantitative and qualitative results of this research, both showed that it was possible to convey emotions to some extent, using specific methods. The problem was examined through a multi-layered study, combining three different experiments. To investigate the subject, I decided to start the research by examining the communication of positive and negative attributes. Since the product design process usually aims to develop positive experiences, it seemed a logical start. This idea came when discussing the project with a psychologist. This division made it easier for the test subject to communicate the feelings object induces, without the need for verbal communication.

Is it possible to convey the difference between positive and negative, through the physical form of objects?

The first part of this research investigated if it was possible to convey the positive and negative difference between objects. Results section (Chapter 5.1) describes these results more accurately. The results show that the average division was similar than the intended one. Positive feelings are in general more promising emotions to convey through products, than negative ones. In my opinion, expressing positive emotions could benefit the whole user experience and the effect of the entire product. Because of this, the mere difference of positive and negative attributes is interesting. The first test examined the possibility to communicate this difference to individuals. According to the results, (Figures 1, 2, 3) test subjects were able to comprehend the objects as they were designed to be understood. It is resulting in the correct division of almost all of the objects.



After combining and analyzing the data gathered with all different methods, the results from each section of the study complimented each other. It is clear that the research showed some logic between the results and the original idea. Emotions could be conveyed using these ideas and strategies with similar measurements. Psychological theories of emotions turned out to be an effective way to examine new processes to transmit and communicate feelings to individuals. In my opinion, this idea benefits future product development processes. The research could be iterated and reapplied to those projects in the future.



6.2 The future

This research offered the basis for future product development, using processes to convey particular emotions to end users. This thesis is the first step towards this vaster goal, of utilizing these new methodologies, explored in this thesis project. The processes investigated in the argument may be used as an advantage, in terms of differentiation from competitors and having a high impact. That being said, to achieve the future goal, further research must be conducted including actual product concept where usage related attributes are involved. Since this study did not take any usage related qualities into account, this needs to be addressed in the next steps. However, the thesis project offers a great platform to utilize the newly found processes efficiently. This enables a fast and efficient way to test attributes of actual product concepts, to achieve future products with high impact. The founding of this research will be utilized in Nightingale Heaths product design processes. The results can be directly applied to already existing ideas and concepts, for later testing.

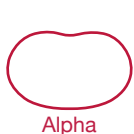
The research turned out to offer valuable insights on conveying emotions in future products. This being said, some challenges also occurred, which need to be taken into consideration before the actual application. The primary problem in this study was the communicational aspects. It is a fact, that emotion is such a complex and personal process; it is tough to communicate them forward in an accurate way. This study utilized words to describe and demonstrate the emotions measured. This means the results are based on only words and verbal comments. It is not, however, proved with any other methods that the feelings and emotions occurred.

The major challenge with this thesis was the lack of context. Each of the eight objects represented an emotion and word cluster. They did not have any other meaningful reason for existence, rather than this research. This means that the settings are different when evaluating objects with an actual purpose, and usage. To illustrate this with an example; if all of the eight objects, were representing a handle for a screwdriver, the results would have been incredibly different. This is why a new study needs to be conducted if similar results are required for a specific product concept. That being said, this research offered a valuable prove of a point; those same methods could be utilized with different future design projects.

7. Final words

Working in Nightingale Health, during this Bachelor's thesis project has been an incredibly rewarding experience. I feel truly honored to provide the company with new ideas and processes, to help with upcoming projects. I hope the results and outcomes of this thesis will turn out to be profitable for those endeavors. A significant personal benefit, gained from this thesis process has been the learnings. This project has taught me to appreciate note-taking, sketching, and planning. Approximately 60% of the whole thesis project was spent on planning and background research. This experience has been valuable, compared to usual course projects, done during studies. The fact that I was able to benefit Nightingale Health and gain personal learnings with this project has been to most rewarding part.

As final words, I would like to thank all people of Nightingale, for believing in this thesis project, and for all the help and guidance I have received. Special thank-yous belong to Nightingale Health's fellow industrial designers; Eetu Leppälä, and Antti Kangas who supported my work during the whole process. I would also like to express gratitude to psychologist Siiri Nuolioja, for those in-depth conversations we had while eating sushi and cake.



Alpha



Beta



Gamma



Delta



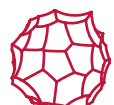
Epsilon



Zeta



Eta



Theta

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